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LENDER CONSISTENCY IN HOUSING CREDIT MARKETS

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ABSTRACT

Increased reporting requirements imposed by amendments to the Home Mortgage Disclosure Act (HMDA) have provided an unprecedented opportunity to compare lending patterns across markets and lenders. Most of the initial work released using data for the first amended HMDA reporting year (1990) has focused on market-level racial differences in denial rates for home mortgages. This study examines a different aspect: how and why individual institutions vary in their propensity to attract minority applicants and to approve applications from those customers.

In a 1992 paper, the authors studied differences among individual lenders in the rates at which they originate minority and low-income loans, concluding that most of the variation can be attributed to differences in application rates rather than to differences in treatment. Here, the authors extend the previous analysis to examine the relationship between various measures of lender-market and financial performance and minority loan originations. The investigation includes all housing credit loans--home purchase, refinancings, and home improvement loans--but is limited to minorities. The authors first determine each lender's propensities to attract minority customers and to approve them for credit, and then conduct regressions to examine whether various measures of lender performance and structure can explain cross-lender variation in lending patterns.

Remarkably little consistency is found in any of the residual patterns or across loan types, and lender structure and performance explain hardly any of the variations in minority loan applications or dispositions. The analysis reveals differences among lenders in their housing market activities, but the authors emphasize that the HMDA data do not contain enough relevant information about the loan applicants to draw any firm conclusions about the reasons behind the observed differences.

Introduction

Increased reporting requirements imposed by amendments to the Home Mortgage Disclosure Act (HMDA) in 1989 have provided an unprecedented opportunity to compare lending patterns across markets and lenders. Most of the initial work released using data for the first amended HMDA reporting year (1990) has focused on market-level racial differences in denial rates for home mortgages. Our study examines a different aspect of the situation, namely how and why individual institutions vary in their propensity to attract minority applicants *and* to approve applications from those customers.

This paper is the second in a series. In the first (Avery, Beeson, and Sniderman [1992]), we used data from the 1990 HMDA sample of home purchase mortgage loan applications to separate differences among individual lenders in the rates at which they originate minority and low-income loans into two components: (1) differences in the rate that they receive applications from minorities and low-income applicants; and (2) differences in their treatment of minority and low-income applications. We further decompose each of these sources of variation into portions stemming from applicant and location characteristics and "pure lender" differences. We conclude that most of the variation across lenders in minority and low-income origination rates can be attributed to differences in application rates rather than to differences in treatment. Somewhat surprisingly, we find that very little of the lender variation in *either* minority application rates or dispositions can be attributed to applicant economic characteristics, and while property location explains a nontrivial portion of the cross-lender variance in application rates, most of the lender variation is unexplained.

In this study, we extend the previous analysis to examine the relationship between various measures of lender-market and financial performance and minority loan originations. We expand our investigation to include *all* housing credit loans -- home purchase, refinancings, and home improvement loans -- but limit the analysis to minorities.

The analysis is sequenced in two steps. First, we develop a procedure that enables us to determine, after controlling for the economic and locational characteristics of its applicant pool, each lender's propensities to attract minority customers and to approve them for credit. The national 1990 HMDA applicant-level data is partitioned according to its three types of loan products. For *each* loan type, we estimate two linear probability regressions: (1) a model predicting an application's disposition, and (2) a model predicting the applicant's race. Among the independent variables included in the regressions are applicant characteristics such as income, loan amount, income-to-loan amount, loan guarantee status, and fixed effects (separate intercepts) for each lender/census tract combination. The fixed effects in these six equations yield six lender residuals for each firm. We also construct two overall lender residuals for each lender by aggregating the fixed effects associated with each of the lender's three loan products.

In the second step of the analysis, we use the six specific and two overall pure-lender residuals as dependent variables in regressions to examine whether various measures of lender performance and structure can explain cross-lender variation in lending patterns. Independent variables include the type of institution (commercial bank, savings and loan, etc.), the number of applications and market share of the lender, the percentage of applications geared for loans guaranteed by the Federal Housing Administration (FHA) or Department of Veterans Affairs (VA), the percentage of loans sold to federally guaranteed mortgage pools (FNMA, GNMA, or FHLMC), and, for a subset of institutions, measures of profitability and aggregate loan performance.

Our analysis cannot explain very much of the cross-lender or within-lender variations in applications or dispositions. Remarkably little consistency is found in any of the residual patterns. We detect virtually no correlation between institutions' treatment of minority applicants (either absolutely or relative to nonminorities) and their propensity to attract minority applicants. Patterns across the three loan types are also weak, with correlations approximately 0.15 for attracting minority applicants and 0.05 for the accept/denial decision. Although overall patterns suggest that minority loan applicants are significantly more likely to be denied than nonminorities, it does not appear that this is caused by a small subset of institutions.

A second principal conclusion emerges: Lender structure and performance explain hardly any of the variations in minority loan applications or dispositions. Institutions with higher profitability and lower capital ratios are marginally more likely to attract black applicants; however, they are also marginally more likely to deny them. Institutions with higher percentages of loan originations sold to mortgage pools appear to attract fewer minorities; however, there is little impact on mortgage denials. And, even after the FHA/VA status of an individual borrower is taken into account, it appears that institutions receiving a higher percentage of FHA/VA applications are marginally more likely to attract minorities, but also marginally more likely to deny their applications.

Although our analysis reveals differences among lenders in their housing market activities, we do not attempt to draw conclusions regarding lender discrimination. We emphasize in our discussion that the HMDA data do not contain enough relevant information about the loan applicants to make any firm judgments about the reasons for observed differences in lender activities.[1]

The remainder of this paper is organized as follows. In the next section, we discuss the methodology used to isolate the pure lender effects by controlling for applicant economic and locational characteristics. In section II, we provide a brief description of the data and the procedures used to prepare data for this study. Univariate sample statistics are also presented. In section III, we present the basic analytic results for the loan denial process. Similar analysis is presented for the loan application process in section IV. Finally, we provide a summary and concluding remarks in section V.

I. Empirical Model

The purpose of this paper is to identify lender characteristics associated with particular minority lending patterns. We seek to isolate true institutional differences; that is, differences that stem from specific strategies or procedures adopted by lenders rather than from the markets or applicants they serve. To identify these lender effects, we must first control for application characteristics (such as loan size, applicant income, loan type [FHA/VA, conventional], and property location) that may be correlated with race. We do this by using a two-stage estimation procedure. In the first stage, we identify lender-specific differences in minority and nonminority application and denial rates that cannot be explained by characteristics of the application or location of the property. These lender residuals are then used as dependent variables in second-stage regressions relating these residuals to specific lender characteristics.

In the first-stage regression, we use individual application data to estimate the following fixed-effects linear probability models for each of three types of loan applications: home purchase, refinance, and home improvement:

(1) $DENIAL_{iMTL} = \beta_{A1}AC_i + \beta_{R1}RACE_i + \beta_{M1}MSA_M + \beta_{T1}TRACT_T + \beta_{L1}LENDER_L + e_{1iMTL}$,

(2) $MINORITY_{iMTL} = \beta_{A2}AC_i + \beta_{M2}MSA_M + \beta_{T2}TRACT_T + \beta_{L2}LENDER_L + e_{2iMTL}$,

where DENIAL is coded one if application i is denied and zero otherwise, and MINORITY is coded one if applicant i is a minority (Native American, Black, or Hispanic) and zero otherwise. AC is a vector of application characteristics reported in the HMDA data. AC includes gender, marital status, occupancy, income, loan amount, income-to-loan ratio, FHA or VA status, and interactions among these variables. RACE is one of eight variables indicating the race of the applicant or co-applicant; MSA, TRACT and LENDER are dummy variables indicating which metropolitan statistical area, census tract, and lender the application relates to; and e is a residual.

The parameter estimates from equations (1) and (2), together with characteristics of the applications received (AC, RACE, MSA, and TRACT), are used to predict minority application and minority denial rates for each lender. Lender minority application and minority denial residuals are measured as the difference between the lender's predicted and actual minority application and denial rates. The minority application residual is then the lender's propensity to draw a higher or lower percentage of minority applicants than is typical for lenders active in its market, given the characteristics of the applications actually received by the lender. Similarly, the minority denial rate residual is the lender's propensity to deny a higher or lower percentage of minority applications than is typical for lenders active in its market (a similar residual can be formed for each lender's treatment of nonminorities).

In addition to constructing these two residuals for each of the three types of loans, we also construct an overall minority application residual and an overall minority denial residual as weighted averages of the residuals for each type of loan. For the minority application residual, total loan applications were used to form the weights; for the minority denial residual, minority applications were used. Thus, the first stage of the estimation yields eight separate lender residuals.

In the second stage of estimation, these eight lender residuals are regressed on various lender characteristics. The general form of the estimation is as follows:

(3) $\text{DENIAL RESIDUAL}_{Lj} = \gamma_{NMj}\text{NONMINORITY}_{Lj} + \gamma_{Mj}\text{MARKET}_{Lj} + \gamma_{Fj}\text{FINANCE}_{Lj} + u_{Lj}$,

(4) $\text{APPLICATION RESIDUAL}_{Lj} = \gamma_{Mj}\text{MARKET}_{Lj} + \gamma_{Fj}\text{FINANCE}_{Lj} + u_{Lj}$,

where for the L^{th} lender, the subscript j indicates the type of residual or market (home purchase, refinance, home improvement, or overall). MARKET is a vector of measures of each lender's activity in the overall mortgage market, the minority mortgage market, and government-sponsored mortgage lending programs. FINANCE is a vector of measures of the financial performance of the lending institution. MARKET variables are available for all lenders in our sample, while FINANCE variables are available only for a subset of lenders. In some instances, therefore, equation (3) is estimated only for the subset of lenders for which the relevant data are available. Our particular interest is in the *relative* treatment of minority and nonminority applicants. Therefore, we also include each lender's nonminority denial rate residual, NONMINORITY, as a regressor in the minority denial residual equation (3).

II. Data

Mortgage Loan Application and Disposition Data

Data on individual loan applications and dispositions for 1990, used in the first-stage estimation, are collected under the 1989 revisions to the Home Mortgage Disclosure Act (HMDA). The amended HMDA data constitute one of the most complete sets of statistics on mortgage lending available in the United States. Virtually all commercial banks, savings and loan associations, credit unions, and other mortgage lending institutions (primarily mortgage bankers) that have assets of more than $10 million and have an office in a metropolitan statistical area (MSA) are required to report on *each* mortgage loan application acted upon by the institution during the calendar year. Lenders must report the loan amount, the census tract of the property, whether the property is owner-occupied, the purpose of the loan (home purchase, home improvement, or refinance), loan guarantee (conventional, FHA, or VA), action taken by the lender (loan approved and originated, application approved but withdrawn, application denied), the race and gender of the loan applicant (and co-applicant, if any), and the income relied upon by the lending institution in making the loan decision.[2]

In total, 9,333 financial institutions made HMDA filings for 1990 on 6,595,089 loan applications. Our analysis focuses on the 3,489,235 loan applications for 1-4 family properties in MSAs that were acted upon by the lenders.[3] Of these loans, 1,984,688 were home purchase loans; 716,595 were applications to refinance an existing mortgage loan; and 787,952 were applications for home improvement loans (generally second or third mortgages). These applications were received by 8,745 separate institutions operating in 40,008 census tracts in all 340 of the nation's MSAs defined as of 1990. For our analysis, we define lenders at the MSA level; thus, an institution reporting applications for two different MSAs is treated as two different lenders. There are 23,248 such lenders in our sample.[4]

Descriptive statistics for the applications reported in the 1990 HMDA are given in table 1. Statistics are listed separately for home purchase, refinance, and home improvement loan applications. Clearly, housing credit applicants are a select sample of American households. Household mean income ($63,071) is substantially higher than that reported for all households in the 1989 Survey of Consumer Finances ($35,700).[5] The racial composition of the study sample also appears to differ from that of all U.S. households. Blacks constituted 6.9 percent of the housing loan applicants, yet were 7.4 percent of the homeowners and headed 11.2 percent of the households in 1990. Similarly, Asians, Native Americans, and others accounted for 5.6 percent of the housing loan applicants but only 2.1 percent of the homeowners and 3.0 of the households.

Hispanics were more evenly represented: 6.6 percent of the applicants, 4.1 percent of the homeowners, and 6.4 percent of the households.[6] It is also apparent that denial rates differ substantially by race for all three types of loans.

Lender Characteristics Data

Data on the market and financial characteristics of lenders are drawn from two sources: the 1990 HMDA data, described above, and Reports on Income and Condition (call reports) filed by institutions with federal regulators on December 31, 1990. To link the data from the different sources, we first identified the lender's regulatory agency using information reported in HMDA. Once the regulatory agency was identified, the call reports were matched to HMDA lenders using institution names and MSA locations.

Measures of each lender's activity in the overall mortgage market, the minority mortgage market, and government-sponsored mortgage lending programs are constructed from the HMDA data. As stated previously, these variables are defined at the lender-MSA level. Variables reflecting the size of the lender in the mortgage market include categorical measures of the total number of mortgage loan applications received by the lender (less than 100, 100 to 500, more than 500); the lender's share of all applications made in the MSA; and three variables indicating the portion of total applications to the lender, which are for either home purchases, refinancings, or home improvements. The lender's participation in minority lending is measured by a categorical variable indicating more than 100 minority applications, and by the lender's share of all minority applications in the MSA. The lender's participation in federally sponsored mortgage lending programs is measured by the share of each lender's home purchase mortgage applications received under the FHA or VA program, and by four variables indicating the share of each lender's home purchase mortgage originations subsequently sold to FNMA, FHLMC, GNMA, and other institutions.

Financial variables and type of institution are taken from the call reports. Six types of institutions are identified using the call report data together with the name of the institution: commercial banks, thrifts (savings and loans and mutual savings banks), credit unions, mortgage subsidiaries of commercial banks, mortgage subsidiaries of thrifts, and independent mortgage banks. Financial variables are measured for the whole institution, not lender-by-MSA, and are present for almost all commercial banks, thrifts, and credit unions (information on the parent institution is used for subsidiaries). However, we lacked such information for independent mortgage banks, as they are not required to file call reports. Financial variables used include the institution's capitalization rate (capital/assets), return on assets (earnings/assets), real estate loans relative to total assets, non-real estate loans relative to assets, and deposits relative to assets. Loan portfolio performance is measured by the share of total loans charged off in the previous year, the share of real estate loans charged off, the share of mortgage loans that were nonperforming (delinquent), and the share of mortgage loans that were repossessed in the previous year.

The distribution of applications and denial rates by these lender characteristics is reported by type of loan and race of applicant in table 2. The means and standard deviations for variables used in the second-stage regression (equation [3]) are reported by type of lender in table 3.

III. Lender Characteristics and Minority Denial Rates

Parameter estimates for the first-stage regressions predicting the probability of denial (equation [1]) by type of loan are reported in appendix tables 1-3. Similar regressions predicting the race of applicant (equation [2]) are reported in appendix tables 4-6.[7] As shown previously, these estimates can be used to form minority application and minority denial rate residuals for each lender. In this section we focus on the minority denial rate equations; and in the section that follows, on the minority application rate equations.

Second-stage regression results for minority denial rate residuals are shown in tables 4 and 5.[8] In these estimations, we include the lender's nonminority denial rate as an independent (and highly significant) variable. Thus, a positive coefficient on other variables means that an increase in the value of the independent variable is associated with a rise in the lender's minority denial rate, *holding other characteristics of the loan application and the denial rate for nonminorities constant.*

Because all variables were not available for all lenders, several samples were used. All institutions were used in regressions excluding financial variables; separate regressions were run for credit unions, thrifts, and commercial banks (including subsidiaries) for which financial variables were available. In addition, separate regressions were run for home purchase, refinance, and home improvement loans, and for a sample restricted to large institutions (more than 100 total loan applications). In each case, the sample was restricted to institutions that received at least one application from a minority during 1990.

In evaluating the regression results, it may be useful to organize the discussion around conjectures with respect to lender behavior that have been raised in the debate over potential mortgage lending bias.

Lender Consistency

Much of the judicial and regulatory effort in the area of mortgage lending oversight has been focused on identifying individual cases of lender bias. If overall patterns of differential treatment of minority and nonminority mortgage applicants stemmed from a few lenders with discriminatory practices or cultures, one would expect to see consistency in individual lender behavior across loan products. As shown in table 6, there does not appear to be strong evidence that is the case. This table shows the correlations of the absolute minority and relative minority (minority minus nonminority) denial-rate residuals across the three loan products.

Correlations among the absolute minority denial-rate residuals across the three loan products range from 0.153 to 0.230. However, most of this correlation appears to stem from the institution's overall "toughness"; the correlations among the relative minority denial-rate residuals range only from 0.046 to 0.064. This lack of persistence is evident if we examine the 2,814 lenders that received minority applications for all three loan types. Of these, 403 had relative minority denial rates that were less than predicted (negative residuals) for all three loan types. However, if there were no persistence across loan types, *by chance* we would predict that 305 of these lenders would have negative residuals for all three loan products. Similarly, 511 lenders have higher relative minority denial rates than predicted for all three loan products, versus the 400 predicted by chance alone. To put this in perspective, if lender behavior were perfectly correlated across loan products, we would predict that 100 percent of the lenders would show consistent behavior. If behavior were completely unrelated across loan types, by chance alone, we would predict that 25 percent would show consistency. The actual figure, 32 percent, is much closer to the random prediction than that of perfect lender consistency.

Economies of Scale

It has often been argued (see ICF [1991]) that most underwriting guidelines are developed based on experience with standard, nonminority applications. Consequently, applications from minorities are more likely to require verification and processing efforts outside the lender's normal experience, and thus be more costly. If so, this might lead to higher lender denial rates for minorities either because lenders lack the expertise to evaluate them properly, or because lenders choose not to expend the extra effort.

If these arguments were true, then we would expect minority denial rates to be lower for lenders receiving more minority applications, since these lenders would have more of an incentive to invest in the expertise required to evaluate minority applications. Evidence on this score is mixed. In our results for all institutions (column 1 of table 4), we find no significant relationship between a lender's minority denial rate and either the absolute number of minority applications it processes or its market share (though the point estimates are negative). On the other hand, in differentiating among large lenders (column 7 of table 5), we find a significantly lower minority denial rate for lenders processing a large share of the minority applications in their MSA. Answers to two commonly asked questions appear in the row labeled "Commercial Bank Types" at the bottom of table 4. We find a significantly lower minority denial rate for minority-owned institutions (column 7 of table 4), which presumably have particular expertise in dealing with minorities. On the other hand, banks that are part of a bank holding company, and thus apt to be more specialized, are significantly more likely to reject minority applicants than would be predicted.

Secondary Mortgage Market

Several conjectures have been raised about the impact of the secondary mortgage market on minority applicants. It has been argued (see ICF [1991]) that the need to sell, or potentially sell, a loan in the secondary market has led to adherence to more rigid, standardized underwriting standards. Minorities, it has been argued, may be hurt by this practice because minority loan applicants (and neighborhoods) tend to be more idiosyncratic and less likely to conform to standard "rules." If this is true, it should mean that large lenders, with potentially large diversified portfolios of their own and less need to sell, should bear less risk in making nonconformable loans. Thus, we might expect to see lower minority denial rates among such lenders. However, we generally find no relationship between the number of applications processed by a lender and the lender's minority denial rate. The exceptions are credit unions, and in differentiating among large lenders. However, in both of these cases, the minority denial rate is significantly higher for lenders processing a large share of the mortgage applications in their MSA.

It is also possible to examine the direct evidence of participation in the secondary market on minority denial rates. We find no evidence that lenders who sell large portions of their loans in the secondary market have higher minority denial rates. In fact, the estimates in table 4 indicate that lenders who sell large portions of their loans in this market are in general *less likely*, not more likely, to deny minority applications. Thus, any negative impact on minorities resulting from more rigid underwriting standards imposed by the secondary market appears to have been more than offset by more favorable treatment resulting from the use of objective standards or in originators perceiving that risk can be passed on.

FHA/VA Loan Programs

The federally guaranteed loan programs, FHA and VA, are quite prominent in the mortgage lending bias literature. On the one hand, minority borrowers have traditionally favored FHA/VA loans, and FHA/VA lenders should have more experience in dealing with minorities, and thus give them more favorable treatment. On the other hand, lenders have argued that FHA and VA originators bear the risk of post-default recourse for nonconforming loans, which might harm minorities who are less likely to have conformable applications.

Again, the evidence is mixed. Lenders with a large share of FHA/VA loans tend to deny minority applicants at a higher rate than would be expected based on their nonminority denial rate and other application characteristics, including whether a specific application is for an FHA/VA loan. Though this effect is significant for FHA loans, the effect is quite small: a 10-percentage-point increase in FHA loans as a share of total home purchase loans increases the minority denial rate by less than half of 1 percent;

and if this loan is later resold to GNMA (the government-sponsored pool for FHA/VA loans), the effect is more than offset by the lower minority denial rates associated with resale to GNMA.

On the other hand, the direct effects of FHA/VA loans on denial rates, as reported in appendix tables 1-3, go in the opposite direction. Focusing on home purchase loans, which comprise most FHA/VA loans, the estimates in appendix table 1 indicate that FHA/VA loans are less likely to be denied than conventional loans, and that this effect is of the same order of magnitude for all racial groups (the probability of denial is reduced by 2 percent for blacks, 4 percent for Hispanics, and 3 percent for whites and Asians). This implies that the absolute denial rate for minorities would be lower, but that relative rates would be unaffected.

Financial Performance

A number of conjectures have been raised about the relationship between minority applicant treatment and loan performance (see Becker [1993]). Several apparently contradictory arguments have been made. One is that if lenders arbitrarily deny black loan applicants because they have a "taste" for discrimination, then in a competitive environment, such lenders would "pay" for these practices by showing lower profits and higher loan losses. On the other hand, some argue that if race is correlated with performance (perhaps because minorities suffer discrimination in other markets), then lenders who use race in underwriting (albeit illegally), and consequently deny a higher percentage of minority applicants, will show higher-than-average profits.

We find mixed results with respect to performance. Higher minority denial rates tend to be associated with higher earnings for commercial banks (columns 7 and 8 of table 4), but also with higher nonperforming mortgage rates for thrifts. Moreover, most other measures of performance appear to be unrelated to the minority denial rates.

IV. Lender Characteristics and Minority Application Rates

In this section, we examine the relationship between lender characteristics and minority application rates. The parameter estimates are reported in tables 7 and 8. Since the dependent variables in these regressions are the differences between the actual and predicted application rates for each lender, a positive coefficient indicates that the lender characteristic is associated with disproportionately large minority application rates, controlling for the characteristics of the specific applications received by the lender, such as loan size, applicant income, FHA/VA loans, and property location.

As was the case with the minority denial-rate regressions, it may be useful to organize our discussion of the application rate equations around several conjectures that have been raised in the lending bias literature.

<u>Lender Consistency</u>

Table 9 presents the correlations between the minority application rate residuals for the three loan products and the correlations of these residuals with those of the denial rate equations. Clearly, there is evidence of more persistence among the three loan products in the application process than in the denial equations. Correlations among the application rate residuals range from 0.148 to 0.188. This conclusion is reinforced by an examination of the patterns of the lenders engaged in all three markets.

Of the 2,814 such lenders, 699 have application rates that are larger than predicted for all three loan types, compared with an expected number of 456, and 456 have application rates lower than predicted for all three loan types, compared with an expected number of 263 lenders. Overall, the 41 percent of lenders showing a persistent pattern is considerably larger than the 25 percent we would expect by chance, but much lower than the 100 percent implied by perfect correlation.

It is also interesting to examine the relationship between the minority application residuals and the absolute and relative minority denial-rate residuals. Overall, those institutions with higher-than-expected minority applications are associated with higher-than-expected absolute denial rates, but lower-than-expected relative denial rates. In all cases, however, the correlations are small (the largest is .041). In some ways this is a surprising result, because it suggests that minority applicants do not seem to be attracted to institutions that treat them better on either an absolute or a relative basis.

The overall levels of fit shown in tables 7 and 8 reflect a general lack of consistency and persistence. The R^2's reported (ranging from 0.02 to 0.14) indicate that our lender characteristics explain very little of the cross-lender differences in minority application rates. Certain kinds of lenders (particularly mortgage banks) tend to process disproportionately large numbers of minority applications, even after controlling for cross-lender differences in propensities to process FHA/VA and low-income loan applications. Interestingly, both commercial banks and thrifts tend to process a disproportionately large share of their minority applications through their mortgage subsidiaries. We also find that banks that are part of a bank holding company process disproportionately few minority applications, and minority-owned banks process disproportionately large numbers of minority applications.

Secondary Market and FHA/VA Loans

The presence of a strong secondary market has been raised with respect to the service of the minority community as well as with the treatment of minority applicants. The argument has been made that small "niche" lenders can serve the minority community only if they can sell loans to a diversified secondary market. Thus, while any large lenders with more efficient marketing and processing operations might attract their share of minority applications, the only small institutions that could do so would be those engaged primarily in originating for the secondary market. Indeed, we find that large institutions do process a disproportionate share of minority applications relative to smaller lenders (approximately 92 percent of minority applications compared with 89 percent of nonminority, as shown in table 2). However, this difference appears to be related to the racial composition of the geographic and product markets served by these different-sized lenders. After controlling for differences in loan applications such as income, loan size, FHA/VA, and property location, we find that large lenders process disproportionately fewer minority applications than do small lenders (column 1 of table 7). Only among the largest lenders do we find that increases in market share are associated with a rise in minority application rates.

On the other hand, lenders active in FHA/VA lending tend to receive a disproportionately large share of minority applications, *even after controlling for whether or not a specific application is for an FHA/VA loan.* That is, lenders active in FHA/VA lending tend to attract more minority applications for conventional loans. While significant, the effect on minority application rates is quite small: a 10 percentage-point increase in FHA lending increases minority application rates by less than one-sixth of a percentage point. Also, recall that these lenders have higher minority denial rates. For home purchase applications, these two effects cancel out, and the net effect is that increases in the percent of FHA lending have no effect on the number of minority loans that are actually originated by the lender.

Conversely, lenders selling large portions of their loans in the secondary market process disproportionately *fewer* minority applications than do lenders who hold these loans in their own portfolios. Again, it is important to emphasize that this is after controlling for characteristics of the loan itself, which may increase the likelihood that it is sold, and controlling for other lender characteristics. In general, compared with nonminority applications, more minority applications are processed by lenders who sell more than one-third of the loans they originate.

Financial Performance

We find some interesting patterns of minority lending related to the financial variables. For commercial bank and thrift lenders, increases in either real estate or non-real estate loans as a share of their total assets are associated with larger minority application rates. These lenders also were found to have disproportionately low minority denial rates, indicating that institutions that focus on lending originate disproportionately large numbers of minority mortgage loans. We also determine that highly capitalized lenders (viewed as an indication that the institution is relatively conservative) have disproportionately low minority application rates--but recall that there was no evidence that these lenders deny a disproportionately large share of their minority applicants.

Most interestingly, we find that commercial banks processing a larger-than-expected number of minorities have *higher-than-expected* earnings. However, such banks are associated with higher loan charge-off rates. Although thrifts show no relationship between minority applications and overall earnings, higher-than-predicted minority application rates are associated with higher-than-predicted rates of nonperforming or repossessed mortgages.

V. Summary and Conclusion

Increased reporting requirements imposed by amendments to the Home Mortgage Disclosure Act (HMDA) in 1989 have provided an unprecedented opportunity to compare lending patterns across markets and lenders. Most of the initial work released using data for the first HMDA reporting year (1990) has focused on market-level racial differences in denial rates for home mortgages. Our study examines a different aspect of the situation: how and why individual institutions vary in their propensity to attract minority applicants *and* to approve applications from those customers.

In this study, we extend the previous analysis to examine the relationship between various measures of lender-market and financial performance and minority loan originations. We expand our investigation to include all housing credit loans -- home purchase, refinancings, and home improvement loans -- but limit the analysis to minorities. First, we develop a procedure that enables us to determine, after controlling for the economic and locational characteristics of its applicant pool, each lender's propensities to attract minority customers and to approve them for credit. We estimate a fixed-effects model and obtain six lender residuals for each firm. We also construct two overall lender residuals for each lender by aggregating the fixed effects associated with each of their three loan products.

In the second step of the analysis, we use the six specific and two overall pure-lender residuals as dependent variables in regressions to determine whether various measures of lender performance and structure can explain either cross-lender or within-lender variations in lender patterns.

Our analysis cannot explain very much of the cross-lender or within-lender variations in applications or dispositions. We find remarkably little consistency in any of the residual patterns. There is virtually no correlation between institutions' treatment of minority applicants (either absolutely or relative to minorities) and their propensity to attract minority applicants. Patterns across the three loan types are also weak, with only sparse evidence of consistency in lender behavior. Although overall patterns suggest minority loan applicants are significantly more likely to be denied than nonminorities, it does not appear that this is caused by a small subset of institutions. A second principal conclusion emerges: Lender structure and performance explain hardly any of the variations in minority loan applications or dispositions.

Although our analysis reveals differences among lenders in their housing market activities, we do not attempt to make judgments about lender discrimination. We emphasize in our discussion that the HMDA data do not contain enough relevant information about the loan applicants to draw any firm conclusions regarding the reasons for observed differences in lender activities.

ENDNOTES

1. These data may be useful in conjunction with other data, such as those collected from regulatory audits. Regulators may find the information particularly helpful in signaling potential problem lenders. For a thorough discussion of both the issues and data, see Canner and Smith (1991, 1992) and Garwood and Smith (1993).

2. Institutions with assets of less than $30 million were not required to report race, income, and gender for loan applicants. In addition, the HMDA filings contained many errors and inconsistencies even after extensive editing by the receiving agencies. We dealt with missing and implausible data using a "hot deck" imputation procedure similar to that used by the U.S. Census Bureau. Applications with missing or implausible data were statistically matched to applications for the same type of loan in the same census tract that came closest to them in reported characteristics (race, loan action, income, and loan amount). Missing values were filled in using the variable value of the matched observation. Overall, income was imputed for 4.9 percent, loan amount for 1.5 percent, gender for 4.0 percent, and race for 5.6 percent of the study sample applications.

3. Applications were omitted from our sample for the following reasons: loans purchased from other institutions (1,137,741) because they did not require an action by the reporting lender; applications for properties outside the MSAs in which the lender had an office (1,523,429 loans) because of inconsistent reporting requirements; applications for multifamily homes and those that never reached the stage of lender action because they were either withdrawn by the applicant or closed for incompleteness (444,684).

4. The 8,745 financial institutions filing 1990 HMDA reports that had at least one loan in the study sample operated in an average of 2.7 MSAs. This translated into 23,248 study lenders when lenders were defined at the MSA level.

5. See Kennickell and Shack-Marquez (1992) for a description of the Survey of Consumer Finances. In the HMDA data, household income may be slightly understated, as it reflects only the portion of an applicant's income needed for mortgage qualification.

6. The percent Hispanic in the HMDA sample is slightly higher than the overall U.S. population, due in part to the inclusion of Puerto Rico, and the percent black is slightly lower. U.S. figures are taken from the whole 1990 Census, which may differ somewhat from the coverage of the study sample, in that rural areas are included.

7. These equations were actually estimated in two steps. In the first step, individual application characteristics were used with separate intercepts for *each* lender-census tract combination (a single component fixed effect). The home purchase equation had 607,631 such intercepts; the refinance equation, 326,535; and the home improvement equation, 267,158. In the second step, an iterative procedure, equivalent to regressing the fixed-effects intercepts against the MSA, census tract, and lender dummies, was used to identify the MSA, tract, and lender effects. By construction, the MSA effects were normalized to have overall sample means of zero, and within each MSA, lender and tract means were normalized to zero. In cases where lender and tract effects were not identified (a lender was the only lender in a tract and did all of its business there), the effect was assigned to the tract. The minority application residuals used in this paper are taken directly from these estimated lender effects. Since we wanted denial rate residuals separately for minorities and nonminorities, the other elements of the model (AC, RACE, MSA, and TRACT) were used to form a predicted denial rate for each applicant. The minority denial rate residual for each lender was formed by averaging the residuals from this prediction over each lender's minority applicants. The nonminority lender residual was formed similarly. We also should note that the reported standard errors in the appendix tables are those from a standard regression program. These may be biased due to heteroskedasticity stemming from the fact that the underlying model is a linear probability model.

8. The reported regressions here, and in tables 7 and 8, are unweighted with lender as the unit of observation. Standard errors are those reported in a standard regression package, and thus are unadjusted for heteroskedasticity or for the fact that the dependent variable is a sample residual formed from another estimation. Weighted regressions were also run, with similar substantive conclusions.

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Table 1: Characteristics of Mortgage Applications, National Sample, 1990 HMDA

	Home Purchase			Refinance			Home Improvement		
	Percent Sample	Percent Loan$	Denial Rate	Percent Sample	Percent Loan$	Denial Rate	Percent Sample	Percent Loan$	Denial Rate
Race of Applicant									
Native American	0.6%	0.6%	19.3%	0.6%	0.6%	21.2%	0.9%	1.0%	22.7%
Asian (or Pacific Islander)	4.6	6.8	14.4	4.9	7.2	21.3	2.5	5.4	27.7
Black	6.2	4.8	29.4	5.1	3.9	28.8	10.3	5.9	43.4
Hispanic	6.6	6.4	22.1	7.7	7.3	25.6	5.7	5.4	35.4
White	81.4	80.5	13.1	80.9	79.9	16.4	79.9	81.3	20.3
Other	0.7	1.0	19.8	0.7	1.0	26.8	0.8	1.0	35.4
Race of Co-applicant									
No Co-applicant	28.4	24.1	17.3	24.8	23.8	21.0	33.5	26.3	29.8
Same Race as Applicant	69.4	73.4	13.8	73.2	73.9	17.1	64.9	71.6	20.8
Different Race than Applicant	2.2	2.5	15.6	2.0	2.3	19.4	1.6	2.1	21.1
Gender									
Male Applicant, Female Co-applicant	64.0	68.2	13.4	67.7	69.2	16.8	58.0	65.8	19.7
Female Applicant, Male Co-applicant	4.3	4.2	18.6	4.9	4.2	21.4	6.9	6.1	28.6
Male Applicant and Co-applicant	2.0	2.3	16.4	1.6	2.0	19.6	0.8	1.0	27.8
Female Applicant and Co-applicant	1.2	1.2	18.1	0.9	0.8	20.2	0.8	0.8	28.1
Single Male Applicant	16.9	15.6	17.9	14.7	15.7	22.0	19.5	16.3	29.5
Single Female Applicant	11.5	8.5	16.5	10.1	8.1	19.6	14.0	9.9	30.1
Owner-Occupied	93.6	94.5	14.9	90.9	91.5	18.1	97.2	96.1	23.8
Loan Type									
Conventional	75.1	82.9	14.9	96.4	98.2	17.9	96.0	97.6	23.8
FHA	20.4	13.7	14.5	2.9	1.4	23.0	3.9	2.1	24.2
VA	4.5	3.4	15.8	0.7	0.4	21.3	0.1	0.3	22.0
FmHA	0.0	0.02	2.0	0.0	0.0	22.5	0.0	0.0	28.2
Lender Action									
Loan Denied	14.8	13.1		18.1	20.6		23.8	20.2	
Loan Accepted and Withdrawn	2.9	3.5		4.1	5.4		3.3	3.7	
Loan Originated	82.3	83.4		77.8	74.0		72.8	76.1	
Loan Kept by Originator (% of originations)	44.9	47.7		60.3	61.3		93.0	85.2	
Loan Sold to FNMA (% of originations)	14.5	14.4		13.4	11.8		2.0	4.7	
Loan Sold to GNMA (% of originations)	10.5	7.6		1.8	1.2		0.2	0.5	
Loan Sold to FHLMC (% of originations)	9.0	9.1		10.8	9.7		0.9	2.6	
Loan Sold Elsewhere (% of originations)	21.1	21.2		10.6	16.0		3.9	7.0	
Reasons for Denial (of Loans Denied) [1]									
No Reason Given	32.0	29.5		26.7	25.8		36.2	42.6	
Debt-to-income Ratio	16.0	17.7		17.8	17.2		20.2	16.9	
Employment History	4.2	3.1		2.3	1.8		2.4	1.9	
Credit History	26.0	22.1		25.3	22.1		29.7	19.5	
Collateral	8.2	8.9		14.3	16.4		9.2	9.3	
Insufficient Cash	4.0	4.1		1.6	1.9		0.8	1.0	
Unverifiable Information	2.8	3.8		3.7	4.5		1.5	1.8	
Application Incomplete	2.6	3.7		2.9	3.5		1.4	1.8	
Mortgage Insurance Denied	0.6	0.7		0.2	0.2		0.2	0.2	
Other	14.8	17.8		17.6	18.7		9.8	14.1	
Memo Items:									
Median Income ($1,000s)		$48			$56			$39	
Median Loan Request ($1,000s)		$77			$83			$10	
Number of Loans		1,984,688			716,595			787,952	

[1] Up to three reasons for denial could be given, and answers were voluntary. Each category gives the percent of all denials that gave that reason as one of the three.

SOURCE FOR ALL TABLES: Authors.

Table 2: Distribution of Mortgage Applications and Denial Rates by Lender Characteristics[1], 1990

	Home Purchase				Refinance				Home Improvement			
	Nonminority		Minority[2]		Nonminority		Minority[2]		Nonminority		Minority[2]	
	Percent Sample	Denial Rate	Percent Sample	Denial Rate	Percent Sample	Denial Rate	Percent Sample	Denial Rate	Percent Sample	Denial Rate	Percent Sample	Denial Rate
Type of Institution												
Commercial Banks	23.1%	16.8%	18.9%	31.7%	30.0%	17.5%	22.4%	30.5%	70.1%	22.2%	74.3%	37.9%
Thrift Institutions	33.5	11.9	35.1	21.8	45.3	16.2	56.0	25.3	20.0	23.6	16.6	43.4
Credit Unions	1.1	10.0	0.7	21.8	2.8	10.0	1.9	19.2	7.7	8.5	6.9	16.1
Bank Subsidiaries	19.8	14.7	18.7	26.0	9.2	18.7	5.9	29.6	1.1	22.0	0.9	31.3
Thrift Subsidiaries	7.6	12.8	8.2	23.5	4.6	21.2	5.5	27.9	0.4	25.1	0.5	31.3
Other Mortgage Banks	14.9	11.2	18.3	20.5	8.1	19.0	8.3	26.2	0.7	25.9	0.8	31.2
Size of Institution												
< 100 Applications	11.1	15.6	8.0	26.2	12.2	16.5	7.6	26.8	13.1	15.2	10.0	28.2
100-500 Applications	37.6	13.8	29.4	25.6	32.9	15.8	18.7	26.9	30.6	17.0	23.4	31.0
> 500 Applications	51.3	12.8	62.6	23.9	34.8	18.0	73.6	27.3	56.2	25.1	66.7	40.4
Market (MSA) Share of Institution												
Less than 1 Percent	21.1	14.4	19.0	24.3	25.8	17.9	21.3	27.3	20.7	18.5	19.3	31.9
1-5 Percent	43.5	12.9	43.0	24.4	39.4	16.6	40.5	26.2	33.3	21.7	33.6	37.7
More than 5 Percent	35.4	13.7	37.9	25.2	34.8	17.2	38.2	28.1	46.0	22.7	47.2	37.7
Size of MSA												
< 25,000 Applications	51.5	14.1	39.5	26.4	42.0	15.7	22.3	27.9	50.9	17.7	39.1	33.3
> 25,000 Applications	48.5	12.8	60.5	23.0	58.0	18.1	77.7	27.8	49.1	25.1	60.9	39.6
FHA/VA (First Mortgage Applications)												
Less than 15 Percent	58.4	15.3	53.6	26.0	84.2	17.4	88.4	27.1	85.2	21.3	85.7	36.6
15-50 Percent	20.4	11.0	17.6	23.3	10.9	14.6	6.5	26.6	11.8	24.2	9.9	38.9
More than 50 Percent	21.2	11.0	28.8	22.8	4.8	17.3	5.1	28.8	3.0	17.6	4.4	29.3
First Mortgages Sold[3]												
Less than 33 Percent	35.5	15.1	30.9	27.0	51.9	17.1	45.3	28.3	68.6	21.3	71.3	37.1
33-67 Percent	16.6	13.6	19.4	24.5	19.0	17.8	22.8	28.0	18.1	20.7	17.2	34.7
More than 67 Percent	47.9	12.3	49.8	23.1	29.1	16.8	32.0	24.7	13.3	23.3	11.5	37.3
Return on Assets (Earnings)[4]												
Loss	23.6	13.3	26.6	24.3	24.1	17.6	26.2	26.9	15.2	24.6	14.8	41.1
0-.5 Percent	37.6	12.5	40.3	23.5	38.0	16.7	40.0	26.6	24.8	25.2	26.0	41.8
More than .5 Percent	38.8	16.3	33.2	29.6	37.9	17.0	33.7	28.4	60.1	19.3	59.2	33.7
Capitalization (Capital to Assets)[4]												
Less than 6 percent	58.0	15.2	67.6	26.5	56.2	18.5	70.2	28.3	52.9	24.5	59.0	39.2
More than 6 Percent	42.0	12.6	32.4	25.2	43.8	14.9	29.8	25.6	47.1	18.1	41.0	33.9
Total	100.0	13.2	100.0	25.3	100.0	16.8	100.0	26.6	100.0	20.6	100.0	39.6

[1] Lenders operating in multiple MSAs are treated as separate institutions.
[2] Native Americans, blacks, and Hispanics.
[3] Based on loans both originated and sold during 1990.
[4] Earnings and capitalization data are not available for any independent mortgage banks and some other institutions.

Table 3: Regression Sample Variables--Descriptive Statistics

	All Institutions		Credit Unions		Thrift Institutions		Commercial Banks	
	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error	Mean	Standard Error
Nonminority Denial Residual	.004	.170	-0.083	.136	.014	.153	.014	.172
Institution Type								
Commercial Bank (Dummy)	.344	.475	–	–	–	–	–	–
Thrift Institution (Dummy)	.212	.408	–	–	–	–	–	–
Credit Union (Dummy)	.082	.275	–	–	–	–	–	–
Commercial Bank Subsidiary (Dummy)	.152	.359	–	–	–	–	–	–
Thrift Subsidiary (Dummy)	.064	.244	–	–	–	–	–	–
Independent Mortgage Bank (Dummy)	.145	.352	–	–	–	–	–	–
Size Measures								
Market Share of MSA (Fraction)	.021	.039	.008	.020	.025	.043	.024	.044
101 to 500 Applications (Dummy)	.333	.475	.175	.381	.410	.492	.338	.473
More than 500 Applications (Dummy)	.098	.297	.013	.115	.143	.350	.092	.289
Market Share of Minorities in MSA	.023	.049	.013	.139	.025	.052	.027	.052
More than 100 Minority Appl. (Dummy)	.060	.237	.011	.014	.078	.268	.057	.231
Government Programs								
FHA Share of 1st Mortgage Applications	.131	.247	.011	.068	.112	.216	.094	.195
VA Share of 1st Mortgage Applications	.033	.093	.025	.110	.029	.088	.026	.079
FNMA Share of 1st Mortgages Originated	.115	.215	.046	.169	.108	.201	.093	.193
FHLMC Share of 1st Mortgages Originated	.066	.159	.014	.080	.072	.154	.059	.157
GNMA Share of 1st Mortgages Originated	.062	.171	.014	.076	.039	.127	.053	.155
Other Sale Share of 1st Mortgages Orig.	.180	.310	.090	.254	.161	.282	.167	.301
Loan Types								
Home Purchase Share of Applications	.567	.319	.239	.252	.613	.262	.525	.310
Refinance Share of Applications	.196	.210	.182	.242	.260	.207	.179	.191
Home Improvement Share of Applications	.237	.310	.579	.350	.127	.220	.296	.308
Financial Ratios								
Non Real Estate Loans /Assets	–	–	.415	.125	.066	.074	.304	.139
Real Estate Loans / Assets	–	–	.241	.125	.580	.194	.318	.166
Deposits / Assets	–	–	.900	.046	.814	.120	.804	.149
Capital / Assets	–	–	.029	.030	.011	.270	.076	.057
Earnings / Assets	–	–	.009	.013	-0.004	.016	.004	.015
Loan Performance Measures								
Total Loans Charged Off / Total Loans	–	–	–	–	.009	.045	.010	.017
Nonperforming Mortgages / Total Mortgages	–	–	–	–	.018	.038	–	–
Mortgages Charged Off / Total Mortgages	–	–	–	–	.001	.007	–	–
Mortgages Repossessed / Total Mortgages	–	–	–	–	.020	.066	–	–
Commercial Bank Types								
In a Bank Holding Company (Dummy)	–	–	–	–	–	–	.806	.395
Minority Bank (Dummy)	–	–	–	–	–	–	.008	.087
Memo Item:								
Number of Observations	14,787		1,196		3,910		7,663	

Table 4: **Lender Characteristics and Residual Differences in Minority Denial Rates by Type of Institution (Dependent Variable Is the Unexplained Lender Residual from the Minority Denial Rate Equation)**

	All Institutions		Credit Unions		Thrift Institutions		Commercial Banks	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Intercept	.01544•	.00698	.04195	.17514	.01155	.03239	-0.00442	.03620
Nonminority Denial Residual	.81666•••	.01264	.71165•••	.05557	.76091•••	.02587	.81795•••	.01850
Institution Type (Base Group Commercial Banks)								
Thrift Institution (Dummy)	-0.00631	.00626	–	–	–	–	–	–
Credit Union (Dummy)	-0.07071•••	.00827	–	–	–	–	–	–
Commercial Bank Subsidiary (Dummy)	.01188	.00844	–	–	–	–	.01951	.01130
Thrift Subsidiary (Dummy)	.00611	.01021	–	–	.00594	.01170	–	–
Independent Mortgage Bank (Dummy)	-0.02184••	.00844	–	–	–	–	–	–
Size Measures								
Market Share of MSA (Fraction)	.15295	.10088	1.28952•	.53039	.06273	.15530	.12304	.14560
101 to 500 Applications (Dummy)	.00274	.00493	-0.01745	.02222	-0.00055	.00877	-0.00028	.00715
More than 500 Applications (Dummy)	-0.00243	.00966	-0.04365	.08643	.01053	.01525	-0.01327	.01425
Market Share of Minorities in MSA	-0.07869	.07759	-0.13257	.24296	.01144	.12113	-0.10953	.11767
More than 100 Minority Appl. (Dummy)	.00667	.01107	.00047	.09107	-0.02388	.01761	.00278	.01638
Government Programs								
FHA Share of 1st Mortgage Applications	.03882••	.01189	.04744	.10964	.02254	.02490	.07415•••	.02178
VA Share of 1st Mortgage Applications	.01268	.02518	-0.01486	.07948	.05265	.04867	.00957	.04507
FNMA Share of 1st Mortgages Orig.	-0.00584	.01104	.01901	.04641	-0.00103	.02088	-0.01407	.01831
FHLMC Share of 1st Mortgages Orig.	-0.00575	.01429	.24241•	.09654	-0.04757	.02564	-0.00586	.02335
GNMA Share of 1st Mortgages Orig.	-0.11351•••	.01682	-0.16846	.11511	-0.07214	.04119	-0.15669•••	.02981
Other Sale Share of 1st Mortgages Orig.	-0.01174	.00805	-0.02428	.02962	-0.01260	.01640	-0.00926	.01166
Loan Types								
Refinance Share of Applications	.01942	.01132	.07503	.04308	.01675	.02150	.04466•	.01816
Home Improvement Share of Applications	.00596	.00957	-0.00760	.03041	.01541	.01960	.02368	.01383
Financial Ratios								
Non Real Estate Loans / Assets	–	–	-0.02462	.07654	-0.10845•	.05447	-0.01350•	.02926
Real Estate Loans / Assets	–	–	-0.05691	.07687	-0.04018	.02460	.00299	.02478
Deposits / Assets	–	–	-0.09148	.18417	.04294	.03449	.00145	.03079
Capital / Assets	–	–	-0.35967	.28516	-0.00183	.04341	-0.18231•	.07717
Earnings / Assets	–	–	-0.22286	.65537	-0.03311	.35556	.89638••	.32927
Loan Performance Measures								
Total Loans Charged Off / Total Loans	–	–	–	–	.11375	.37354	.29433	.35377
Nonperforming Mortgages / Total Mortgages	–	–	–	–	.32885••	.11784	–	–
Mortgages Charged Off / Total Mortgages	–	–	–	–	-1.96726	2.22421	–	–
Mortgages Repossessed / Total Mortgages	–	–	–	–	.03417	.08053	–	–
Commercial Bank Types								
In a Bank Holding Company (Dummy)	–	–	–	–	–	–	.02586••	.00840
Minority Bank (Dummy)	–	–	–	–	–	–	-0.11704•••	.03454
Memo Items:								
Number of Observations	14,787		1,196		3,910		7,663	
R squared	.252		.157		.208		.237	
Dependent Variable Mean	.013		-.121		.028		.033	
Dependent Variable Standard Deviation	.290		.273		.263		.299	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Table 5: Lender Characteristics and Residual Differences in Minority Denial Rates by Type of Loan
(Dependent Variable Is the Unexplained Lender Residual from the Minority Denial Rate Equation)

	Home Purchase		Refinance		Home Improvement		Large Institutions	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Intercept	.06019•••	.00786	.03219••	.01001	-0.00591	.01036	.01699•	.00799
Nonminority Denial Residual	.74959•••	.01457	.72808•••	.01893	.77497•••	.01842	1.07175•••	.01867
Institution Type (Base Group Commercial Banks)								
Thrift Institution (Dummy)	-0.01039	.00721	-0.00287	.00926	.01931	.01013	-0.00878	.00571
Credit Union (Dummy)	-0.06347•••	.01233	-0.03311•	.01530	-0.08043•••	.01133	-0.05395•••	.01108
Commercial Bank Subsidiary (Dummy)	.02560••	.00988	.03387•	.01434	-0.01205	.02246	-0.01763•	.00830
Thrift Subsidiary (Dummy)	.02656•	.01182	.00025	.01693	-0.10729•••	.02734	-0.02265•	.01006
Independent Mortgage Bank (Dummy)	-0.01292	.01007	-0.00600	.01405	.00569	.02066	-0.03075•••	.00868
Size Measures								
Market Share of MSA (Fraction)	.02189	.11232	.27244	.14820	.25291	.15564	.19856••	.06799
101 to 500 Applications (Dummy)	.00587	.00576	.00108	.00844	.00770	.00844	–	–
More than 500 Applications (Dummy)	.00016	.01067	-0.01322	.01363	.00110	.01554	-0.00306	.00576
Market Share of Minorities in MSA	.01037	.08652	-0.17230	.11516	-0.20910	.11763	-0.13288•	.05304
More than 100 Minority Appl. (Dummy)	-0.00635	.01201	.00629	.01428	-0.00217	.01658	-0.01168	.00695
Government Programs								
FHA Share of 1st Mortgage Applications	.04123••	.01362	-0.01235	.02383	.04519	.03061	.02036	.01247
VA Share of 1st Mortgage Applications	.03578	.02990	-0.07132	.05578	-0.02239	.06151	.03769	.03120
FNMA Share of 1st Mortgages Originated	-0.02704•	.01318	.00840	.01889	.03266	.02427	-0.00682	.01171
FHLMC Share of 1st Mortgages Orig.	-0.02174	.01654	-0.02548	.02260	-0.01797	.03396	.00534	.01431
GNMA Share of 1st Mortgages Orig.	-0.13719•••	.01960	-0.05067	.03371	-0.07580	.04874	-0.02142	.01771
Other Sale Share of 1st Mortgages Orig.	-0.02062•	.00956	-0.01334	.01467	.00267	.01549	.00520	.00819
Loan Types								
Home Purchase Share of Applications	-0.05213•••	.01212	–	–	–	–	–	–
Refinance Share of Applications	–	–	-0.02059	.01763	–	–	.02570	.01416
Home Improvement Share of Applications	–	–	–	–	.02055	.01386	.00554	.01105
Memo Items:								
Number of Observations	11,798		7,185		6,450		6,393	
R squared	.212		.182		.245		.367	
Dependent Variable Mean	.030		.025		-.014		.014	
Dependent Variable Standard Deviation	.303		.307		.333		.196	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Table 6: Minority Denial Rate Correlations, All Institutions

	Relative Denial Rate[1]				Minority Denial Rate			
	Total	Home Purch.	Refinance	Home Improv.	Total	Home Purch.	Refinance	Home Improv.
Relative Denial Rate[1]								
Total	1.000							
Home Purchase	.801•••	1.000						
Refinance	.588•••	.046•••	1.000					
Home Improvement	.710•••	.064•••	.048••	1.000				
Minority Denial Rate								
Total	.812•••	.656•••	.488•••	.589•••	1.000			
Home Purchase	.688•••	.818•••	.060•••	.082•••	.861•••	1.000		
Refinance	.536•••	.076•••	.825•••	.048••	.691•••	.230•••	1.000	
Home Improvement	.644•••	.069•••	.057••	.799•••	.798•••	.187•••	.153•••	1.000

[1] Minority denial rate residual minus nonminority denial rate residual.

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Table 7: Lender Characteristics and Residual Differences in Minority Application Rates by Type of Institution (Dependent Variable Is the Unexplained Lender Residual from the Minority Application Rate Equation)

	All Institutions		Credit Unions		Thrift Institutions		Commercial Banks	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Intercept	.05830•••	.00377	.18339	.13622	.07085•••	.01526	.07217•••	.01769
Institution Type (Base Group Commercial Banks)								
Thrift Institution (Dummy)	-0.01341•••	.00338	–	–	–	–	–	–
Credit Union (Dummy)	.03232•••	.00444	–	–	–	–	–	–
Commercial Bank Subsidiary (Dummy)	.02772•••	.00449	–	–	–	–	.01944•••	.00546
Thrift Subsidiary (Dummy)	.04170•••	.00547	–	–	.05631•••	.00544	–	–
Independent Mortgage Bank (Dummy)	.02436•••	.00454	–	–	–	–	–	–
Size Measures								
Market Share of MSA (Fraction)	-0.06913•	.03291	-0.64894	.33831	.05046	.04761	-0.09613•	.03939
101 to 500 Applications (Dummy)	-0.05077•••	.00265	-0.06017•••	.01724	-0.04249•••	.00412	-0.04834•••	.00349
More than 500 Applications (Dummy)	-0.04408•••	.00432	-0.03500	.05331	-0.04023•••	.00604	-0.04372•••	.00590
Government Programs								
FHA Share of 1st Mortgage Applications	.01565•	.00641	-0.08024	.08552	-0.01245	.01177	.03795•••	.01064
VA Share of 1st Mortgage Applications	.01030	.01361	-0.08762	.06197	-0.00066	.02297	.06048••	.02207
FNMA Share of 1st Mortgages Originated	-0.05080•••	.00595	.00853	.03615	-0.05034•••	.00987	-0.03007•••	.00888
FHLMC Share of 1st Mortgages Orig.	-0.03688•••	.00771	-0.15634•	.07534	-0.02587•	.01208	-0.03579••	.01139
GNMA Share of 1st Mortgages Orig.	-0.05352•••	.00906	-0.09488	.08934	-0.08024•••	.01942	-0.06322•••	.01458
Other Sale Share of 1st Mortgages Orig.	-0.03950•••	.00435	-0.04004	.02311	-0.02986•••	.00775	-0.03824•••	.00571
Loan Types								
Refinance Share of Applications	.01216•	.00612	-0.06237	.03362	-0.00049	.01016	.02787••	.00889
Home Improvement Share of Applications	-0.00195	.00516	-0.08119•••	.02353	.00768	.00922	.00926	.00673
Financial Ratios								
Non Real Estate Loans / Assets	–	–	-0.04203	.05976	.09123•••	.02573	.04989•••	.01434
Real Estate Loans / Assets	–	–	-0.03484	.05995	.03050••	.01161	.02236	.01210
Deposits / Assets	–	–	.00324	.14309	-0.07019•••	.01628	-0.04098••	.01494
Capital / Assets	–	–	-0.02583	.22173	-0.06393••	.02049	-0.09009•	.03757
Earnings / Assets	–	–	.15598	.51170	.01696	.16814	.37647•	.16113
Loan Performance Measures								
Total Loans Charged Off / Total Loans	–	–	–	–	.00559	.17631	.40821•	.17286
Nonperforming Mortgages / Total Mortgages	–	–	–	–	.20550•••	.05570	–	–
Mortgages Charged Off / Total Mortgages	–	–	–	–	-0.64308	1.05034	–	–
Mortgages Repossessed / Total Mortgages	–	–	–	–	.10470••	.03802	–	–
Commercial Bank Types								
In a Bank Holding Company (Dummy)	–	–	–	–	–	–	-0.01684•••	.00411
Minority Bank (Dummy)	–	–	–	–	–	–	.18242•••	.01691
Memo Items:								
Number of Observations	14,787		1,196		3,910		7,663	
R squared	.061		.051		.104		.072	
Dependent Variable Mean	.031		.076		.016		.029	
Dependent Variable Standard Deviation	.140		.202		.238		.133	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Table 8: Lender Characteristics and Residual Differences in Minority Application Rates by Type of Loan (Dependent Variable Is the Unexplained Lender Residual from the Minority Application Rate Equation)

	Home Purchase		Refinance		Home Improvement		Large Institutions	
	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error	Parameter Estimate	Standard Error
Intercept	.10840•••	.00424	.17530•••	.00569	.11978•••	.00611	-0.01205•••	.00244
Institution Type (Base Group Commercial Banks)								
Thrift Institution (Dummy)	-0.01249••	.00394	-0.02474•••	.00526	-0.00649	.00597	-0.00271	.00175
Credit Union (Dummy)	.07113•••	.00672	.02482••	.00868	.02182••	.00665	.00696•	.00336
Commercial Bank Subsidiary (Dummy)	.01846•••	.00531	.04115•••	.00812	.07925•••	.01327	.00650••	.00251
Thrift Subsidiary (Dummy)	.03549•••	.00639	.01777	.00962	.07725•••	.01614	.00247	.00306
Independent Mortgage Bank (Dummy)	.02368•••	.00547	.03025•••	.00799	.08618•••	.01219	.00887•••	.00264
Size Measures								
Market Share of MSA (Fraction)	-0.10434••	.03656	-0.13084••	.04959	-0.13704••	.05314	.04440•••	.01240
101 to 500 Applications (Dummy)	-0.07060•••	.00313	-0.11741•••	.00479	-0.07635•••	.00521	–	–
More than 500 Applications (Dummy)	-0.06620•••	.00485	-0.12974•••	.00657	-0.08080•••	.00768	.00041	.00148
Government Programs								
FHA Share of 1st Mortgage Applications	.01570•	.00742	.03161•	.01354	.02373	.01811	.02075•••	.00378
VA Share of 1st Mortgage Applications	.00979	.01631	.05814	.03176	.01945	.03641	.00538	.00952
FNMA Share of 1st Mortgages Originated	-0.05788•••	.00715	-0.03861•••	.01074	-0.03670•	.01436	-0.01508•••	.00356
FHLMC Share of 1st Mortgages Orig.	-0.02312•	.00901	-0.07264•••	.01286	-0.04160•	.02009	.00671	.00437
GNMA Share of 1st Mortgages Orig.	-0.03880•••	.01068	-0.08306•••	.01915	-0.07570••	.02881	-0.01220•	.00541
Other Sale Share of 1st Mortgages Orig.	-0.03919•••	.00522	-0.04941•••	.00834	-0.00627	.00916	-0.00640•	.00250
Loan Types								
Home Purchase Share of Applications	-0.03623•••	.00658	–	–	–	–	–	–
Refinance Share of Applications	–	–	-0.07587•••	.01003	–	–	.01542•••	.00433
Home Improvement Share of Applications	–	–	–	–	-0.06041•••	.00817	.01561•••	.00335
Memo Items:								
Number of Observations	11,798		7,185		6,450		6,393	
R squared	.094		.139		.076		.020	
Dependent Variable Mean	.040		.064		.055		-.002	
Dependent Variable Standard Deviation	.154		.182		.178		.048	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Table 9: **Minority Application and Denial Rate Residual Correlations, All Institutions**

	Minority Application Rate			
	Total	Home Purch.	Refinance	Home Improv.
Minority Application Rate				
Total	1.000			
Home Purchase	.789•••	1.000		
Refinance	.584•••	.156•••	1.000	
Home Improvement	.659•••	.148•••	.188•••	1.000
Relative Denial Rate[1]				
Total	-0.007	-0.009	.005	-0.030••
Home Purchase	-0.014	-0.006	-0.023•	-0.029•
Refinance	-0.015	-0.033••	.018	-0.044••
Home Improvement	-0.026•	-0.049•••	-0.052•••	-0.001
Minority Denial Rate				
Total	.035•••	.028••	.028••	.003
Home Purchase	.023•	.027••	.001	-0.004
Refinance	.023	-0.011	.041•••	-0.005
Home Improvement	-0.001	-0.027•	-0.022	.025•

[1] Minority denial rate residual minus nonminority denial rate residual.

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Appendix Table 1: Linear Probability Model of Loan Denial (1) or Acceptance (0), Home Purchase

	Parameter Estimate	Standard Error
Race (Dummies, "White" Is Base Group)		
Black Applicant	.10258•••	.00403
Hispanic Applicant	.04018•••	.00392
Native American Applicant	.02813•••	.00569
Asian Applicant	.00801•	.00390
Other Race Applicant	.02987•••	.00364
Mixed Race, Minority Co-applicant (Dummy)	.02410•••	.00337
Mixed Race, Nonminority Co-applicant (Dummy)	-0.02690•••	.00329
Owner-occupied (Dummy)	.00630•••	.00132
Income ($1,000's)		
Income	-0.00985•••	.00034
Income Spline at $20,000	.00606•••	.00038
Income Spline at $40,000	.00282•••	.00015
Income Spline at $60,000	.00063•••	.00015
Income Spline at $80,000	.00016	.00017
Income Spline at $100,000	.00011	.00014
Income Spline at $150,000	-0.00004	.00010
Income Spline at $200,000	.00010	.00006
Loan Amount ($1,000's)		
Loan Amount	-0.00193•••	.00020
Loan Amount Spline at $20,000	.00028	.00027
Loan Amount Spline at $40,000	.00179•••	.00018
Loan Amount Spline at $60,000	-0.00018	.00016
Loan Amount Spline at $80,000	.00033•	.00016
Loan Amount Spline at $100,000	-0.00015	.00014
Loan Amount Spline at $125,000	.00012	.00008
Loan Amount Spline at $200,000	-0.00021•••	.00003
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	-0.01016•••	.00105
Ratio of 2.0 to 2.25	-0.01168•••	.00141
Ratio of 2.25 to 2.5	-0.01195•••	.00163
Ratio of 2.5 to 2.75	-0.00737•••	.00187
Ratio of 2.75 to 3.0	.00323	.00227
Ratio over 3.0	.05062•••	.00207
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-0.01886•	.00763
Female Applicant, Male Co-applicant	-0.00766	.00772
Male Applicant and Co-applicant	-0.00390	.00787
Female Applicant and Co-applicant	-0.01021	.00800
Male Applicant, No Co-applicant	.02834•••	.00109
Income, Interacted With No Co-applicant		
Income	-0.00334•••	.00042
Income Spline at $20,000	.00516•••	.00049
Income Spline at $40,000	-0.00051•	.00024
Income Spline at $60,000	-0.00137•••	.00030
Income Spline at $80,000	.00048	.00036
Income Spline at $100,000	-0.00045•	.00019

Appendix Table 1: (continued)

	Parameter Estimate	Standard Error
Race and Marital Status, Interacted With VA Loan		
Black Applicant	-0.00667	.01469
Hispanic Applicant	-0.00866	.01548
Native American Applicant	.04929*	.02208
Asian Applicant	.01699	.01765
White Applicant	-0.02033	.01428
Other Race Applicant	.02562	.02726
No Co-Applicant	-0.00619*	.00311
Race and Marital Status, Interacted With FHA Loan		
Black Applicant	-0.01967	.01446
Hispanic Applicant	-0.04312**	.01445
Native American Applicant	.00429	.01701
Asian Applicant	-0.03294*	.01489
White Applicant	-0.03329*	.01425
Other Race Applicant	-0.02377	.01732
No Co-Applicant	-0.01230***	.00164
Income, Interacted With VA or FHA Loan		
Income	-0.00169**	.00054
Income Spline at $20,000	.00295***	.00058
Income Spline at $40,000	-0.00032	.00024
Income Spline at $60,000	-0.00129***	.00034
Income Spline at $80,000	.00195***	.00052
Income Spline at $100,000	-0.00157***	.00034
Loan Amount, Interacted With VA or FHA Loan		
Loan Amount	.00366***	.00053
Loan Amount Spline at $20,000	-0.00256***	.00069
Loan Amount Spline at $40,000	-0.00231***	.00034
Loan Amount Spline at $60,000	.00066*	.00027
Loan Amount Spline at $80,000	-0.00038	.00028
Loan Amount Spline at $100,000	.00052	.00027
Loan-to-Income Ratio, Interacted With VA or FHA Loan		
Ratio of 1.5 to 2.0	-0.00333	.00222
Ratio of 2.0 to 2.25	-0.00511	.00299
Ratio of 2.25 to 2.5	-0.00612	.00347
Ratio of 2.5 to 2.75	.00029	.00397
Ratio of 2.75 to 3.0	-0.00449	.00475
Ratio over 3.0	-0.00681	.00492
Memo Items:		
Number of Observations	1,984,688	
Mean Denial Rate in Regression Sample	.148	
Number of Tract/Institution Dummies	607,631	
R squared (Including Tract/Institution Dummies)	.456	
R squared (Variation Around Tract/Institution Means)	.022	

* Significant at the 5 percent level.
** Significant at the 1 percent level.
*** Significant at the 0.1 percent level.

Appendix Table 2: Linear Probability Model of Loan Denial (1) or Acceptance (0), Refinance

	Parameter Estimate	Standard Error
Race (Dummies, "White" Is Base Group)		
Black Applicant	.07044•••	.00769
Hispanic Applicant	.04841•••	.00740
Native American Applicant	.02556•	.01042
Asian Applicant	.03900•••	.00751
Other Race Applicant	.03841•••	.00703
Mixed Race, Minority Co-applicant (Dummy)	.00576	.00700
Mixed Race, Nonminority Co-applicant (Dummy)	-0.02336•••	.00694
Owner-occupied (Dummy)	-0.00063	.00223
VA Loan (Dummy)	-0.01573	.00979
Income ($1,000's)		
Income	.00136••	.00053
Income Spline at $20,000	-0.00424•••	.00063
Income Spline at $40,000	.00215•••	.00028
Income Spline at $60,000	-0.00007	.00027
Income Spline at $80,000	.00116•••	.00031
Income Spline at $100,000	-0.00036	.00024
Income Spline at $150,000	.00015	.00016
Income Spline at $200,000	-0.00016	.00009
Loan Amount ($1,000's)		
Loan Amount	-0.00341•••	.00030
Loan Amount Spline at $20,000	.00285•••	.00042
Loan Amount Spline at $40,000	.00079	.00030
Loan Amount Spline at $60,000	.00014	.00031
Loan Amount Spline at $80,000	-0.00010	.00032
Loan Amount Spline at $100,000	.00003	.00027
Loan Amount Spline at $125,000	.00036•	.00015
Loan Amount Spline at $200,000	-0.00055•••	.00004
Loan-to-Income Ratio (Dummies, less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	-0.00218	.00200
Ratio of 2.0 to 2.25	.00451	.00266
Ratio of 2.25 to 2.5	.00700•	.00301
Ratio of 2.5 to 2.75	.01506•••	.00324
Ratio of 2.75 to 3.0	.02567•••	.00375
Ratio over 3.0	.08614•••	.00326
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-0.09269•••	.01395
Female Applicant, Male Co-applicant	-0.08497•••	.01416
Male Applicant and Co-applicant	-0.06650•••	.01467
Female Applicant and Co-applicant	-0.08148•••	.01513
Male Applicant, No Co-applicant	.02477•••	.00251

Appendix Table 2: (continued)

	Parameter Estimate	Standard Error
Income, Interacted With No Co-applicant		
Income	-0.00496•••	.00080
Income Spline at $20,000	.00494•••	.00100
Income Spline at $40,000	.00077	.00055
Income Spline at $60,000	-0.00011	.00062
Income Spline at $80,000	-0.00063	.00068
Income Spline at $100,000	-0.00001	.00035
Interacted With VA or FHA Loan		
Black Applicant	.11374•••	.01851
Hispanic Applicant	.06567•••	.01948
Native American Applicant	.06397	.04933
Asian Applicant	.02391	.02656
White Applicant	.07913•••	.01269
Other Race Applicant	.03883	.05012
No Co-applicant	.00294	.00836
Income	.00005	.00009
Loan Amount	-0.00024	.00015
Memo Items:		
Number of Observations	716,595	
Mean Denial Rate in Regression Sample	.181	
Number of Tract/Institution Dummies	326,535	
R squared (Including Tract/Institution Dummies)	.552	
R squared (Variation Around Tract/Institution Means)	.020	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Appendix Table 3: Linear Probability Model of Loan Denial (1) or Acceptance (0), Home Improvement

	Parameter Estimate	Standard Error
Race (Dummies, "White" Is Base Group)		
Black Applicant	.08045•••	.00682
Hispanic Applicant	.06441•••	.00702
Native American Applicant	.01326	.00869
Asian Applicant	.05435•••	.00734
Other Race Applicant	.08010•••	.00639
Mixed Race, Minority Co-applicant (Dummy)	.00107	.00721
Mixed Race, Nonminority Co-applicant (Dummy)	-0.04042•••	.00772
Owner-occupied (Dummy)	-0.00541	.00357
VA Loan (Dummy)	.23804•••	.02287
Income ($1,000's)		
Income	-0.00243•••	.00038
Income Spline at $20,000	-0.00133•	.00046
Income Spline at $40,000	.00103•••	.00024
Income Spline at $60,000	.00215•••	.00028
Income Spline at $80,000	.00040	.00038
Income Spline at $100,000	.00043	.00033
Income Spline at $150,000	-0.00027	.00027
Income Spline at $200,000	.00001	.00016
Loan Amount ($1,000's)		
Loan Amount	.00035•	.00012
Loan Amount Spline at $20,000	-0.00177•••	.00023
Loan Amount Spline at $40,000	.00202•••	.00036
Loan Amount Spline at $60,000	-0.00064	.00053
Loan Amount Spline at $80,000	.00126	.00067
Loan Amount Spline at $100,000	-0.00108	.00063
Loan Amount Spline at $125,000	.00045	.00049
Loan Amount Spline at $200,000	-0.00058•••	.00016
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	.02051•••	.00406
Ratio of 2.0 to 2.25	.00433•••	.00664
Ratio of 2.25 to 2.5	.02663•	.00922
Ratio of 2.5 to 2.75	.05256•••	.00894
Ratio of 2.75 to 3.0	.08344•••	.01260
Ratio over 3.0	.04087•••	.00621
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-0.10888•••	.00815
Female Applicant, Male Co-applicant	-0.07293•••	.00829
Male Applicant and Co-applicant	-0.04480•••	.01018
Female Applicant and Co-applicant	-0.07792•••	.01003
Male Applicant, No Co-applicant	.03575•••	.00196

Appendix Table 3: (continued)

	Parameter Estimate	Standard Error
Income, Interacted With No Co-applicant		
Income	-0.00464•••	.00048
Income Spline at $20,000	.00430••	.00062
Income Spline at $40,000	.00200•••	.00045
Income Spline at $60,000	-0.00116	.00065
Income Spline at $80,000	-0.00073	.00084
Income Spline at $100,000	.00024	.00047
Interacted With VA or FHA Loan		
Black Applicant	-0.17485•••	.01180
Hispanic Applicant	-0.11894•••	.01370
Native American Applicant	-0.08746•	.03701
Asian Applicant	-0.11298•••	.02374
White Applicant	-0.09436•••	.00898
Other Race Applicant	-0.06075	.04612
No Co-applicant	-0.02010	.00704
Income	.00025	.00012
Loan Amount	.00113	.00026
Memo Items:		
Number of Observations	787,952	
Mean Denial Rate in Regression Sample	.238	
Number of Tract/Institution Dummies	267,158	
R squared (Including Tract/Institution Dummies)	.473	
R squared (Variation Around Tract/Institution Means)	.027	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Appendix Table 4: Linear Probability Model of Minority (1) or Nonminority (0) Application, Home Purchase

	Parameter Estimate	Standard Error
Owner-occupied (Dummy)	.01034•••	.00112
FHA Loan (Dummy)	.12305•••	.01201
VA Loan (Dummy)	.12368•••	.01203
Income ($1,000's)		
Income	-0.00171•••	.00028
Income Spline at $20,000	.00082•	.00032
Income Spline at $40,000	.00040••	.00013
Income Spline at $60,000	.00008	.00012
Income Spline at $80,000	-0.00023	.00015
Income Spline at $100,000	.00048•••	.00012
Income Spline at $150,000	.00018•	.00008
Income Spline at $200,000	-0.00002	.00005
Loan Amount ($1,000's)		
Loan Amount	-0.00159•••	.00017
Loan Amount Spline at $20,000	.00180•••	.00023
Loan Amount Spline at $40,000	-0.00017	.00015
Loan Amount Spline at $60,000	-0.00006	.00014
Loan Amount Spline at $80,000	.00001	.00014
Loan Amount Spline at $100,000	.00052•••	.00012
Loan Amount Spline at $125,000	-0.00053•••	.00007
Loan Amount Spline at $200,000	.00004	.00002
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	-0.00301•••	.00089
Ratio of 2.0 to 2.25	-0.00244•	.00119
Ratio of 2.25 to 2.5	.00093	.00138
Ratio of 2.5 to 2.75	.00068	.00158
Ratio of 2.75 to 3.0	.00455•	.00192
Ratio over 3.0	.00365	.00175
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-0.02765•••	.00644
Female Applicant, Male Co-applicant	-0.01765••	.00652
Male Applicant and Co-applicant	-0.01237	.00664
Female Applicant and Co-applicant	.00225	.00675
Male Applicant, No Co-applicant	-0.01565•••	.00092
Income, Interacted With No Co-applicant		
Income	-0.00157•••	.00036
Income Spline at $20,000	.00184•••	.00042
Income Spline at $40,000	-0.00028	.00020
Income Spline at $60,000	.00036	.00025
Income Spline at $80,000	.00012	.00031
Income Spline at $100,000	-0.00047••	.00016
Marital Status, Interacted With VA or FHA Loan		
No Co-applicant (VA Loan)	.02287•••	.00262
No Co-applicant (FHA Loan)	.00166	.00138

Appendix Table 4: (continued)

	Parameter Estimate	Standard Error
Income, Interacted With VA or FHA Loan		
Income	-0.00141••	.00045
Income Spline at $20,000	.00096•	.00049
Income Spline at $40,000	.00024	.00020
Income Spline at $60,000	-0.00001	.00028
Income Spline at $80,000	-0.00007	.00044
Income Spline at $100,000	.00035	.00029
Loan Amount, Interacted With VA or FHA Loan		
Loan Amount	-0.00171•••	.00045
Loan Amount Spline at $20,000	.00151••	.00059
Loan Amount Spline at $40,000	-0.00025	.00029
Loan Amount Spline at $60,000	.00030	.00023
Loan Amount Spline at $80,000	.00004	.00023
Loan Amount Spline at $100,000	.00048•	.00023
Loan-to-Income Ratio, Interacted With VA or FHA Loan		
Ratio of 1.5 to 2.0	-0.00542••	.00188
Ratio of 2.0 to 2.25	-0.00601•	.00252
Ratio of 2.25 to 2.5	-0.01143•••	.00293
Ratio of 2.5 to 2.75	-0.01058••	.00335
Ratio of 2.75 to 3.0	-0.00848•	.00401
Ratio over 3.0	-0.00967•	.00415
Memo Items:		
Number of Observations	1,984,688	
Mean Minority Share of Regression Sample	.133	
Number of Tract/Institution Dummies	607,631	
R squared (Including Tract/Institution Dummies)	.577	
R squared (Variation Around Tract/Institution Means)	.005	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Appendix Table 5: Linear Probability Model of Minority (1) or Nonminority (0) Application, Refinance

	Parameter Estimate	Standard Error
Owner-occupied (Dummy)	.02004•••	.00171
FHA Loan (Dummy)	.03422•••	.00958
VA Loan (Dummy)	.04686•••	.01099
Income ($1,000's)		
Income	.00048	.00040
Income Spline at $20,000	-0.00076	.00048
Income Spline at $40,000	-0.00049•	.00022
Income Spline at $60,000	-0.00024	.00021
Income Spline at $80,000	.00067••	.00024
Income Spline at $100,000	.00007•••	.00019
Income Spline at $150,000	.00044•	.00012
Income Spline at $200,000	-0.00018	.00007
Loan Amount ($1,000's)		
Loan Amount	-0.00110•••	.00023
Loan Amount Spline at $20,000	.00115•••	.00032
Loan Amount Spline at $40,000	-0.00024	.00023
Loan Amount Spline at $60,000	.00061••	.00023
Loan Amount Spline at $80,000	-0.00026	.00024
Loan Amount Spline at $100,000	.00012	.00021
Loan Amount Spline at $125,000	-0.00052•••	.00012
Loan Amount Spline at $200,000	.00022•••	.00003
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	.00153	.00153
Ratio of 2.0 to 2.25	.00373	.00203
Ratio of 2.25 to 2.5	.00718••	.00230
Ratio of 2.5 to 2.75	.01070•••	.00248
Ratio of 2.75 to 3.0	.01383•••	.00287
Ratio over 3.0	.01628•••	.00249
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-0.02934••	.01066
Female Applicant, Male Co-applicant	-0.03328••	.01082
Male Applicant and Co-applicant	-0.03473••	.01121
Female Applicant and Co-applicant	-0.02352•	.01156
Male Applicant, No Co-applicant	-0.00830•••	.00192
Income, Interacted With No Co-applicant		
Income	-0.00145•	.00061
Income Spline at $20,000	.00083•••	.00076
Income Spline at $40,000	.00062	.00042
Income Spline at $60,000	.00010	.00047
Income Spline at $80,000	.00038	.00052
Income Spline at $100,000	-0.00046	.00027
Interacted With VA or FHA Loan		
No Co-applicant	.01509•	.00637
Income	.00007	.00007
Loan Amount	-0.00027•	.00011
Memo Items:		
Number of Observations	716,595	
Mean Minority Share of Regression Sample	.134	
Number of Tract/Institution Dummies	326,535	
R squared (Including Tract/Institution Dummies)	.666	
R squared (Variation Around Tract/Institution Means)	.006	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
••• Significant at the 0.1 percent level.

Appendix Table 6: Linear Probability Model of Minority (1) or Nonminority (0) Application, Home Improvement

	Parameter Estimate	Standard Error
Owner-occupied (Dummy)	-0.00970•••	.00252
FHA Loan (Dummy)	.01125	.00608
VA Loan (Dummy)	-0.01939	.01667
Income ($1,000's)		
Income	-0.00100•••	.00027
Income Spline at $20,000	.00019	.00033
Income Spline at $40,000	.00020	.00017
Income Spline at $60,000	.00010	.00020
Income Spline at $80,000	.00046	.00027
Income Spline at $100,000	-0.00023	.00023
Income Spline at $150,000	.00053••	.00019
Income Spline at $200,000	-0.00024•	.00011
Loan Amount ($1,000's)		
Loan Amount	-0.00125•••	.00009
Loan Amount Spline at $20,000	.00141•••	.00016
Loan Amount Spline at $40,000	-0.00061•	.00025
Loan Amount Spline at $60,000	.00065	.00038
Loan Amount Spline at $80,000	-0.00075	.00047
Loan Amount Spline at $100,000	.00141••	.00045
Loan Amount Spline at $125,000	-0.00097••	.00035
Loan Amount Spline at $200,000	.00012	.00011
Loan-to-Income Ratio (Dummies, Less than 1.5 Is Base Group)		
Ratio of 1.5 to 2.0	-0.00223	.00288
Ratio of 2.0 to 2.25	-0.00451	.00470
Ratio of 2.25 to 2.5	-0.00355	.00653
Ratio of 2.5 to 2.75	-0.01890••	.00634
Ratio of 2.75 to 3.0	-0.00141	.00893
Ratio over 3.0	-0.01259••	.00440
Applicant Gender (Dummies, Female Applicant, No Co-applicant Is Base Group)		
Male Applicant, Female Co-applicant	-0.03378•••	.00578
Female Applicant, Male Co-applicant	-0.02947•••	.00588
Male Applicant and Co-applicant	-0.03066•••	.00721
Female Applicant and Co-applicant	-0.01309	.07109
Male Applicant, No Co-applicant	-.0.00431••	.00139
Income, Interacted With No Co-applicant		
Income	-0.00163•••	.00034
Income Spline at $20,000	.00140•	.00044
Income Spline at $40,000	-0.00004	.00032
Income Spline at $60,000	.00092•	.00046
Income Spline at $80,000	-0.00117•	.00060
Income Spline at $100,000	.00055	.00033
Interacted With VA or FHA Loan		
No Co-applicant	-0.00193	.00497
Income	-0.00002	.00009
Loan Amount	.00034	.00018
Memo Items:		
Number of Observations	787,951	
Mean Minority Share of Regression Sample	.168	
Number of Tract/Institution Dummies	267,158	
R squared (Including Tract/Institution Dummies)	.657	
R squared (Variation Around Tract/Institution Means)	.004	

• Significant at the 5 percent level.
•• Significant at the 1 percent level.
•••Significant at the 0.1 percent level.